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Artificial intelligence and edge computing for teaching quality evaluation based on 5G-enabled wireless communication technology

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Abstract

Cloud computing and artificial intelligence are now widely used for classroom teaching in higher learning institutes. The digital teaching supported to ICT technologies in colleges serves as a central point for the advancement of modern education; and has become as a mode of instruction and an approach to teaching. Digital teaching has emerged as a major driving force in the advancement of digital economy and digitization of education in colleges. In this paper, we investigate the movable information management system utilized in the digital teaching using edge computing and 5G wireless communication technology. Furthermore, we explain the idea of a mobile data scheme and presents a teaching platform based on the edge computing and 5G-enabled wireless communication technology. The main objective of this work is to develop a digital teaching framework for college students that, in fact, enables digital teaching, the collection, and incorporation of teaching information, the provision of modern education, and sharing of resources. Cutting-edge technology advancements in the educational platform have the potential to improve 5G communication. To implement the cutting-edge technology, all types of technological devices, smart devices, and gadgets from the Internet of Things (IoT) platform are used. We evaluated the proposed system through reasonable assumptions and numerical simulations. The experimental results reveal that the suggested system has significantly improved the teaching efficiency with which digital teaching management is managed in colleges. Moreover, the edge and 5G technology can significantly improve the system performance, in terms of response time, that can be as high as 11.45% when compared to non-cloud based approaches.

Keywords Teaching, Classroom learning, Edge computing, 5G, Wireless communication technology, Education, Students

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Overview of teaching quality evaluation of college classroom education in 5G

In the present era, as Internet technology and information schemes advance quickly, digital creation is growing. Digital construction is continually progressing in all areas of society, including education. Teaching is an essential aspect of digital design. As information management methods are used in educational organizational processes, the use of data systems to provide smart, automated, and precise teaching assessments is becoming increasingly essential [1]. Digital construction's challenges and opportunities have increasingly influenced conventional teaching and classroom management models. Universities and colleges face an increasing number of issues and tasks in teaching and instructional administration management. Traditional ineffective teaching management methods have development constraints. As a result, digitalization and classroom management of teaching have emerged as future growth trends. At the moment, civilization is progressively transitioning to the age of "big data," college and university teaching is slowly digitizing, and technologies like cloud computing and cloud technologies have developed. The rise of cloud computing and edge computing has boosted the capacity to process large amounts of data. Low operational costs, vibrant expandability, and streamlined maintenance and operation are all advantages of cloud computing and edge computing technologies. As a result, different sectors in society have actively promoted them, and their similar industries have also grown immensely.

In addition, since 3G, 4G, and now 5G mobile communication networks have emerged due to rapid advances in wireless technology, voice service has been replaced by mobile broadband data (the fifth generation). Five-generation (5G) wireless data networks have accelerated higher education improvements [2]. 5G is a communication network that helps in the improvement of computer networks that is rapidly gaining power among influential students in the educational sector. The difference in communication-based on 5G is implemented in the form of online classes in the education sector. The implementation of technological gadgets is utilized in the digital classes that are said as cutting-edge technology. The most forward-thinking in the educational sector and established digital classroom based on 5G communication is the form of cutting-edge technology. In addition, the impact of virtual logic network architecture, isolation, and standard technology on application experiences has been highlighted. An approach based on the whole life cycle and synergistic effects have been presented as a two-dimensional method for deploying network slicing technology to achieve this aim [3]. Few approaches concentrate on

the standard technology application of the network architecture along with the slicing technology to help in evaluating the visual-based classes. 5G plays a significant role in an online class and create a wide range of application in the educational field. This research examines the measurement of visual attention during online English training using large-scale 5G and information mining. Because each node is closer to the terminal, the ultra-dense heterogeneous network's capacity and flexibility will significantly improve [4]. Every business sector is undergoing a digital revolution due to the advent of 5G, from being linked to each other to being connected to everything. The combination of 5G and other new technologies creates a wide range of intelligent education applications [5].

Even as free social annotation allows students to create and share information and fosters a lively exchange of ideas, it carries a danger to the safety of students from underrepresented groups [6]. According to Self-Determination Theory (SDT), a student's self-determination level is crucial to academic success. According to SDT, students are more likely to be self-motivated in the classroom if their learning environment caters to their fundamental psychological needs for autonomy, belonging, and competence [7]. The study examined the connections between student confirmation and instructor confirmation. Learning in a college classroom is a typical style of education that takes place inside the confines of the classroom. In-classroom learning necessitates the presence of both the instructor and the student in the classroom. The classroom provides an educational environment that is free of outside distractions. According to survey data, teacher confirmation seems linked to all three aspects of student-to-student assurance [8]. Colleges and institutions are becoming more concerned about student worry. Researchers are trying to figure out how active learning influences student anxiety in science classes, which are moving away from conventional lecturing. Despite educating approximately half of all students, no research has examined the association between anxiety and active learning in community college science classes. Active learning is the best method of teaching which is grooming nowadays in the education sector. The student's interaction in active learning gives the highest performance and feedback to the teachers. Active learning records all the activities of the student's expression like anxiety, sadness, happiness, excited. The student anxiety is more concentrated in the science class in the residence of conventional lecturing and the teaching quality. Active learning is the best method of teaching which is grooming nowadays in the education sector. New ways of teaching and engaging students in the classroom are

possible because of 5G's near-real-time responsiveness. Students can explore and create using the latest technologies and learn how to utilize them [9].

Besides the above, students' expectations for university campus life have arisen in the age of innovative college classroom technology, and they are open to experimenting with new study methods. A creative, sustainable campus and cloud computing may give solutions to enhance student learning techniques and increase the efficiency of an institution's daily operations [10]. All society and everyday life elements have benefited from 5G technology's arrival. Education has significantly benefited from 5G technology, notably online learning, which has a significant impact [11]. The daily activities of an individual can also be recorded and communicated by wireless communication technology based on 5G. All the gadgets used daily have a major impact on wireless technology. Meanwhile, the educational field has brought tremendous growth due to the development of 5G-based wireless technology.

To overcome the constraints of existing college English teaching methods, this study suggests an optimization approach based on 5G technology and artificial intelligence technology for teaching English in colleges and universities [12] in the domain of edge computing. The conventional teacher-centered approach to education seems outdated in today's world. Many individuals, including those with disabilities, find it challenging to keep up with modern educational practices. The advancement of technology may significantly improve these issues. Due to the same internet rates of evaluation and responsiveness available in classrooms, students can continue their studies on their phones or laptop using 5G [13]. Finally, the effectiveness of this strategy will be compared to more traditional ones. According to the study, using this strategy increases students' enthusiasm for learning as well as their hands-on skills [14]. Using 5G technology to implement medical education is a novel method of instruction. Teachers in various educational sectors can handle medical education sources. Cloud computing and 5G-based wireless technologies are more advanced and can be used in a variety of medical applications. Student motivation and excitement for learning may improve their ability to acquire essential competencies [15]. Aside from that, the author provided detailed explanations of the methods/algorithms employed and a list of objectives, issues, and results that matter [16]. The main objectives of this paper are given as follow:

- An orderly edge computing-based classroom atmosphere is established and maintained via meaningful academic learning and social and emotional development.
- To enhance the efficiency of the teaching–learning procedure, evidence from various stakeholders is collected as part of the evaluation process. The results of a successful assessment are valid, dependable, and provide direction and action for future growth.
- In the future, teachers may employ mixed reality apps in all education sectors with edge computing and 5G connection, which has ultra-low latency and high bandwidth.

The remaining of this research paper is as follows. A brief summary of the related work and existing methods is explained in "Related work on teaching quality evaluation of college classroom education" section. In "Edge computing and teaching quality evaluation of college classroom education based on 5g wireless communication technology" section, we deliberate the proposed methods for edge computing-based 5G-WCT. In "Experimental analysis of 5G in college classroom education using edge computing and AI technology" section, we evaluate the proposed model through numerical experiments and simulations. Finally, "Conclusions and future research directions" section is devoted to concluding remarks and offers few directions for future research work.

Related work on teaching quality evaluation of college classroom education

The digitalization of higher education has now begun to include network cloud computing and edge computing skill. The fundamental theories and ideas are presented first. Second, it describes the method of building the college English teaching mobile platform as well as the significance comprehension procedure of the mobile terminal, and it employs the fuzzy neural network for smart computation. Lastly, studies and testing were carried out. In this regard, Han et al. [17] explained the college education teaching quality assessment: evaluation elements are complex, systems are insufficient, and techniques are not comprehensive enough. This research applies an analytic hierarchy process (AHP) to assessing PE teaching quality in colleges to solve these obstacles. First and foremost, the writers identified the characteristics that influence today's college PE instruction. Next, an index system for assessment was constructed, and an evaluation model was built using the AHP and grey system theory (GST). As a consequence of the study, new insights into using cutting-edge approaches in assessing higher education quality have emerged. Chen et al. [18] detailed that education reform and growth in colleges and universities will inevitably promote education modernization via education informatization, given the fast development of today's information technology.

The teaching and administration of colleges and universities have become increasingly dependent on information management. As a result of advances in information technology (IT), this research investigates creating a data mining algorithm-based assessment model for assessing the quality of hybrid classroom instruction. One is a technology-based approach, while the other is an interactive one that utilizes online and offline technology to educate students. The third step is to concentrate on the learning experience of the students. It combines conventional teaching methods and a return to the basics. This brand-new teaching approach will become the standard in educational settings in the years to come. Wu et al. [19] introduced enhancing classroom teaching evaluations using the Distance Binary Tree Support Vector Machine (DBT-SVM) method. The algorithm could estimate the quality of classroom instruction at the colleges and institutions evaluated. Isolated classes are sorted out first using the distance between two sample classes' centers, which is influenced by the space. Classification efficiency and accuracy can be improved, and multi-class classification may be solved using this technique in experiments. Nie et al. [20] explained that computer vision and multimedia technologies, particularly visual tracking technology, and network transmission, are becoming more widespread. Manual student behavior analysis in the traditional classroom is rapidly becoming less effective. Here is a Data Mining (DM)-based approach to evaluating the quality of classroom video resources designed to address the most common challenges encountered when integrating classroom video resources into a multimedia teaching environment. From the standpoint of the behavior chain, this research may identify patterns in online classroom picture teaching behavior.

Observing the visual tracking behavior in an online classroom may be broken down into six parts: selection, presentation, mapping, analysis, and collecting. Ahanger et al. [21] discussed it has Fog-cloud computing and the Internet of Things (IoT). It may be used to generate valuable services. Students may utilize the intelligent recommendation system to choose a subject and educational institution. To increase academic quality, this study presents an IoT-fog-cloud paradigm. IoT technology is employed to collect data on the academic environment to improve the quality of teaching in particular college classes. It's possible to conclude that the proposed framework works based on the experiment's results. The simulated experiment results are compared to the results that may be attained using current best practices. In addition, a mathematical evaluation of the suggested framework was carried out to evaluate its analytical performance. Zeng et al. [22] said the investigation of the overall assessment of teaching

effectiveness in colleges from the perspectives of instructors' teaching competence and student learning effects based on data mining and the hidden Markov model is conducted in this work. The findings of this study may be used as a basis for further research into the integration of computer technology and language instruction. In addition, it serves as a guide and implementation model for enhancing education teaching to college graduates using machine learning technology.

In addition to the above, Cheng et al. [2] proposed that as wireless technology has advanced fast, the mobile communication business has switched from voice service to data service. There should be methods in place for evaluating the quality of classroom instruction so that teachers' work may be considered with objectivity and scientific rigor. Online course instructors may assess their peers by listening to class discussions and looking at student and peer reviews of their work. This gives them a sense of their competence as a teacher and provides valuable feedback. A lot has been made of how well professors are educated and how well students embrace them. An online classroom teaching quality evaluation method is thus critical. Guo et al. [23] introduced that the quality of English instruction has risen in importance due to globalization. One of the most active areas of study is how to evaluate the English-teaching quality of today's college students. Big data analysis is widely used to tackle the present problem of English instruction for college students. There are fresh avenues to explore when it comes to resolving evaluation concerns Based on Big Data Analysis and the development of a College English System. This paper's big data analysis of the college English model has been experimentally verified and determined to have assessment accuracy. An assessment of teaching quality may be made based on the model's dependability.

Liu et al. [1] detailed that using information systems to provide intelligent, automated, and accurate teaching quality assessments is becoming more critical as information management approaches are used in college and university administration operations. Examining several views, including students, supervisors and coworkers, this study investigates the design and execution of an assessment system that can objectively evaluate instructors' teaching effectiveness from various angles. Wang et al. [24] discussed that the 5G network is a digital cellular network capable of handling massive data traffic volumes and many wireless connections. Higher-level educational capacities can only be achieved by incorporating the newest 5G technology into the curriculum. A recent sort of network is being investigated in this project to see whether it can increase student writing skills and encourage resource sharing while strengthening the teacher-student relationship. This research uses 5G

network-dependent education and interaction tools to improve the performance of the proposed system.

Ma et al. [25] proposed accurately and fairly assessing instructors' teaching abilities and quality using various classroom evaluation methodologies. There are several flaws and problems with this plan. As an alternative to conventional teaching evaluation spots, this study uses a fuzzy evaluation approach to integrate qualitative and quantitative assessment to improve the evaluation's impact. To analyse the quality of classroom instruction, first, determine the standard assessment criteria, then choose and use the fuzzy comprehensive evaluation model to create a complete and acceptable evaluation system in higher education. Jiao et al. [26] explained that teachers might objectively and correctly assess teaching techniques, attitudes, and effects and establish a cognitive basis for enhancing dance teaching quality via scientific and practical evaluation of dance college classroom teaching quality. Here, it uses artificial intelligence to assess the quality of dance multimedia instruction at vocational colleges. The findings of the experiments reveal that multimedia education has made class preparation easier for instructors and has raised their professional level. Using courseware to display instructional activities eliminates the negative influence on student presentations owing to disparities in instructor age, technology, and personal comprehension. The experimental class's density was higher than that of the control group.

Edge computing and teaching quality evaluation of college classroom education based on 5g wireless communication technology

Intelligent teaching support systems usually arrange philosophical teaching via the collaboration of the distant server end and local user end in classroom teaching of the existing communication network. Data exchanges between students, teachers, and the server must be high-frequency, large-scale, and long-distance. Because of the slow transmission processing speed, it is common for uploaded data to be unstable, seriously delayed, or even lost during this process. This harms instructors'

excitement for utilizing intelligent systems to plan classroom activities.

Cloud edge computing technology

Edge computing is a type of cloud computing technology that processes the data close to the source of data instead of in an exterior data center or cloud, reducing network latency. Furthermore, it necessitates a minimal cost, so users spend less on local management solutions than on cloud and data center networks. Data generation is accelerating at a record pace as the number of IoT devices rises. As a result, network bandwidth has become restricted, causing the cloud to become overburdened and causing even more data inefficiencies. Edge computing improves application performance by reducing lag, allowing applications to run more quickly and efficiently. Because mobile edge computing technology has its server and powerful storage and computation abilities, and because the server is located so close to the network equipment installed on the physical layer, it significantly enhances the user's quality of service. Furthermore, using edge computing, the network structure can be customized to each person's needs based on continuous teaching, resulting in personalized immersive activities. Furthermore, because edge computing is focused, individual privacy leaking is effectively avoided. Figure 1 depicts the edge computing system's design.

According to the figure above, the cloud edge nodes include SaaS, PaaS, and IaaS, with SaaS being an application software mode for providing software services over the Internet. In this mode, users do not need to invest heavily in the development of hardware, software, and software developers. They only need to pay a small rental fee to appreciate the connected services via the Internet and the manufacturer's maintenance of the entire system. The platform layer of cloud technology should offer features akin to the operating system and developer tools from the viewpoint of "hardware + operating framework Tools + application software" in conventional computing design. Likewise, PaaS aims to provide users with a framework for creating, running, and operating software applications over the Internet. Programmers, just like in

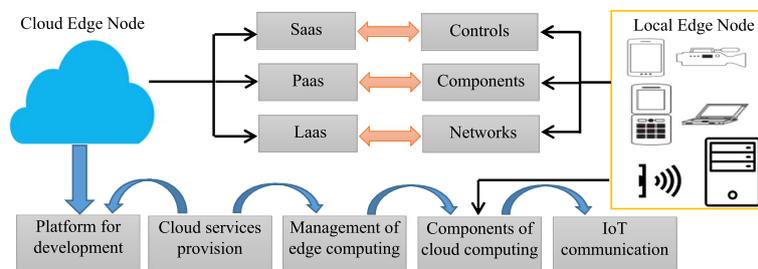


Fig. 1 Design of edge computing system

the personal computer software design mode, can use advanced tools to create and implement application software on a computer running Windows or Linux.

Teaching quality evaluation

Teaching quality evaluation is one of the indicators used to enhance the planning and control of the teaching process. Heads of faculty members, departments, and education programs use evaluation results to adapt their employment policies and course curricula. Measurement and assessment of teaching quality are thus critical: any attempts to improve the quality of education that children receive rely on a precise assessment of that quality. Figure 2 illustrates an educator’s teaching performance is evaluated using a defined scoring system performance assessment are designed to improve student’s educational experience and support instructors’ development in teaching quality evaluation.

An effective teacher must be able to communicate, listen, collaborate, adapt, empathize, and be patient. Classroom presence, the importance of real-world learning, and the exchange of best practices are all components that contribute to excellent teaching quality. The quality of teaching and learning provides a detailed report on the knowledge, skills, and abilities of the students. The quality of teaching outcome is given by the teachers based on the student’s input in all activities. The teachers use their knowledge, skills, and abilities to create a meaningful understanding for the students in different classes. The teacher’s knowledge is helpful for the students in the form of problem-solving skills. Teaching attitude perceptions and thoughts influence their decisions about how they conduct themselves in the classroom. The teaching attitude evaluation focuses on positive guidance and serious teaching. Positive

guidance is given by the teachers to the students. Serious teaching is also some part of teaching but less implementation can be made on this. The way of behavior of students in the classroom is mainly based on communication skills. The way of listening regarding teaching is a major impact on the students. The teaching attitude of the teachers also plays a major role in the perception and thoughts of the individual students. Assignments, video recordings, tests, and other learning materials all fall under the category of necessary readings and information in the content of courses. To help students learn, instructors employ a variety of teaching strategies. A student’s personality and the subject matter at hand both factor into these teaching methods. Several definitions of teacher effectiveness generally refer to a teacher’s ability to help pupils achieve their goals. The student’s educational qualifications and behavioral sense are designed by the teachers. The teachers play a significant role in modeling students’ life based on education. The teachers also help many students to achieve their goals.

It is crucial to explicitly define what the learner will know or be able to do after participating in educational objectives or activities. It is a collection of beliefs and practices relating to a given work sector that is gained via training or education. Professional knowledge is a grasp of theory, procedures, techniques, and principles achieved via a degree-level education. Rather than only concentrating on a specific behavioral goal, advocates of positive guidance argue that all advice methods should aim to improve self-control. Profound teaching seeks to instill in students the ability to think critically and not just accept what is stated or written at face value. Academic performance is strongly influenced by a student’s ability to find inspiration. Students that are more excited about studying stay in school longer put in more effort,

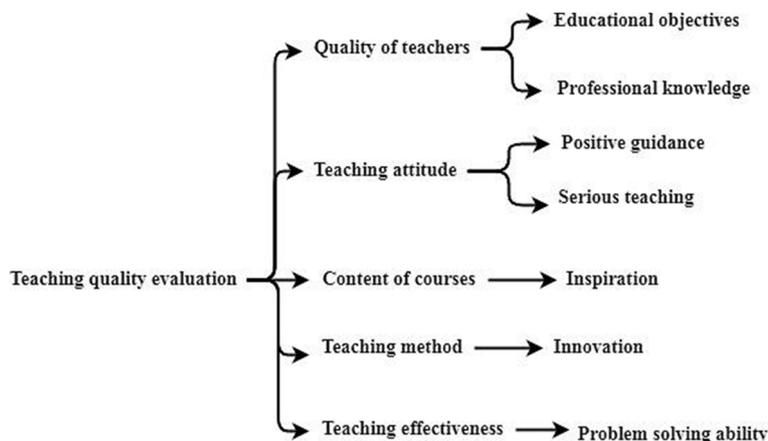


Fig. 2 Overview of teaching quality evaluation

and do better on examinations and in class, as seen by their grades. Regarding education, innovation is coming up with a simple solution to a complex issue to help all students succeed. When it comes to education, new ideas fit the scope of the problem they're trying to solve. The capacity to recognize a problem, analyze its origin, and come up with all feasible solutions to the issue may be classified as problem-solving skills.

This section explains the B/S and C/S structures for evaluating teaching quality. B/S is an abbreviation for Browser/Server, a software architectural system based on servers and browsers. As a result, the B/S construction is extensively utilized in the online system situation, particularly in the building of dynamic communication networks. Furthermore, the benefits of a multilayer design based on the B/S framework can be directly imitated. The B/S building uses the transition of the C/S framework, which divides the server in the C/S framework into a database server and a Web server, giving rise to the B/ three-tier construction. As a result, the upper B/S structure is made up of the presentation layer, the logic layer, as well as the data layer [27], as illustrated in Fig. 3. On the other hand, C/S stands for Client/Server, a software architectural model based on server and client. The C/ S structure is typically two-tiered. The client is in charge of cooperating with the user, while the server is in charge of data management. The client establishes a network connection to the server, accepts the client request, and then transmits the request for the server to start operating the database. The server receives the client's request and sends the data to the client, who then calculates the data and displays the result to the user [28]. Figure 3 also depicts the framework of C/S architecture for evaluating teaching quality.

The derivatives for teaching quality evaluation

Effectively educating people on the Theory of Derivatives is critical and can improve educational quality. Meantime, as we all know, there are many constraints to

teaching and learning about the Theory of Derivatives that must be investigated to find solutions to enhance the quality of vocational student training.

$$O = \sum (P + n)^P / \int \int n_P P_n \|P\| n \left(\frac{P}{n-2} * \frac{1}{2} \right) + (n) \tag{1}$$

Equation 1 denotes that *O* is a total number of teaching quality evaluations, *P* indicates teaching attitude, *n* planning and scheduling of teaching method, $\|P\| n \left(\frac{P}{n-2} * \frac{1}{2} \right)$ indicates the content of course through the $\sum (P + n)^P / \int \int n_P P_n$ from the teaching effective in the evaluation processing.

$$S = \left(T + \prod ii^2 \right) T^{\sum \sqrt{i}} \prod i \exp \sigma^2 \prod T \tag{2}$$

In the above equation, *S* is used for finding assessment for essay reading, *T* is used for learning speed, *i* for educational objectives. Similarly $\exp \sigma$ represents the exponential function of the professional knowledge and $T^{\sum \sqrt{i}} \prod i \exp \sigma^2$ through which the positive guidance's in the severe teaching in the $(T + \prod ii^2)$ problem-solving ability.

5G wireless communication technology

The goal of 5G wireless communication is to provide more users with faster multi-Gbps peak data rates, extremely low latency, greater reliability, huge network ability, and a more consistent user experience. Higher efficiency and performance enable new user experiences and link industries. Wireless networks are made up of cell sites that are partitioned into sectors that transmit messages via radio waves. Long-Term Evolution (LTE) wireless communications of the fourth generation (4G) serve as the foundation for 5G. In contrast to 4G, which includes massive, high-power cell towers to emit signals over greater distances, 5G wireless signals can be transmitted via a large number of small cell stations located in places such as light poles or construction roofs. Numerous small cells are required because the millimeter wave

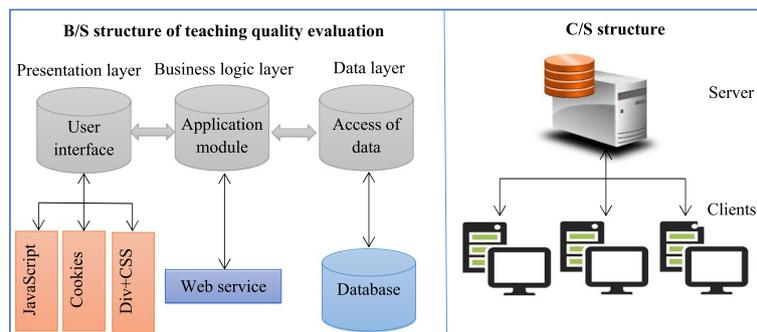


Fig. 3 Architectures of B/S and C/S for teaching quality evaluation

(mmWave) spectrum—the band of spectrum approximately 30 and 300 gigahertz (Ghz) that 5G depends on to produce high speeds—can only travel short distances and is vulnerable to interference from climate and physical hurdles such as trees or buildings. Figure 4 illustrates that more software option to upgrade refers to any software explicitly created to be utilized in a classroom setting.

It covers a wide variety of topics, including anything from software for language instruction to classroom administration to research software. An organization or business is the most probable target of advanced malware, software with a particular purpose and objective. Certain employees, such as system administrators, may be singled out. It is anticipated that 5G, optimized for speed and capacity, would allow a wide variety of new applications and use cases well beyond the smartphone. Due to the advancement in speed and capacity, 5 G-based wireless communication technology reduces the malware threat with the high speed of data transfer among the devices. A most application like health-care, software-based technology, Financial, and banking sector makes use of 5G based technology.

Virtually infinite capacity networks in the term very high capacity network may refer to either an electronic communications network made up entirely of optical fiber parts or an electronic communications network. Finding outliers in a dataset is the goal of anomaly detection. In a dataset, an outlier is a data item that stands out from the others and does not follow the typical pattern. The goal of threat prevention is to keep the network safe from commodity attacks (expected complex) and organize cyber attackers’ advanced, targeted threats. Despite allegations from the department of defense that a new 5G cellular network may interfere with GPS (Global Positioning System) services, the communications commission is expected to approve it. 5G networks employ higher-frequency radio channels to carry signals in faster response time, allowing for quicker download rates. The usage of the highest frequency signals responds in quick

time. 5G network can be correlated with the positioning system for place and location identification by maintaining the secured level of authentication. There is more capacity for data transmission in sure of these bands since they had limited commercial usage in the past. Wireless devices need radio frequencies (a spectrum) to transmit data. Like 4G, 5G utilizes higher, less crowded radio frequencies. Because of this, it can transport more data at a much quicker pace.

The derivatives for 5G wireless communication technology

The data received during 5G wireless communication technology can be calculated in Eq. 3.

$$C = \sec v * [Z] \iiint v Z \frac{(v+1)}{(Z)^{\frac{1}{2}}} \left(v - \sqrt[3]{Z}^v / Z \sqrt{Z} \frac{1}{\delta^2} \right) \tag{3}$$

In the above equation, C represents data received, Z represents the computer laboratory for process received data and v represents action required. Similarly, sec denotes the trigonometric function of faster response time β is the mathematical function of the GPS and δ is the mathematical function of the management, $\left(v - \sqrt[3]{Z}^v / Z \sqrt{Z} \frac{1}{\delta^2} \right)$ from the different techniques with $\sec v * [Z] \iiint v Z \frac{(v+1)}{(Z)^{\frac{1}{2}}}$ more software options to upgrade. The total learning style can be obtained using Eq. 4.

$$F = (R - p) * \sqrt[3]{p} \log_2 R \frac{R}{p} \sqrt[3]{\left(\prod p^R R p \right)} \tag{4}$$

In the above equation, F denotes total learning style, R represents monitoring in technology access, p is security modelling in students, log is the logarithmic function of teaching with technology, $(R - p) * \sqrt[3]{p} \log_2 R \frac{R}{p}$ advanced malware in the calculation for an error rate analysis in college classroom education in the Table 1 communication

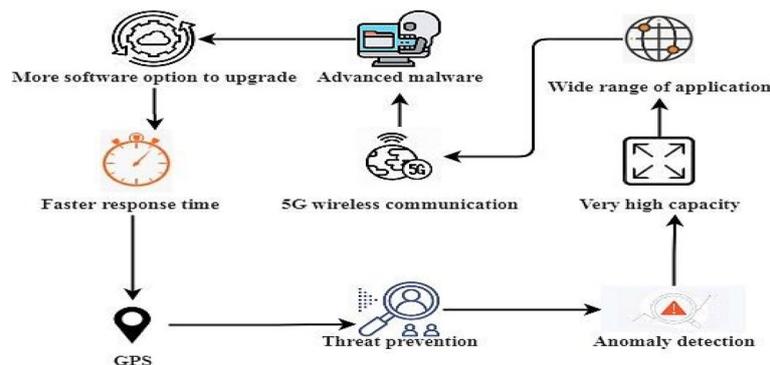


Fig. 4 The 5G wireless communication technology

Table 1 Error rate analysis in teaching quality

No. of Students	5G-WCT	AHP	IT	DBT-SVM	DM	IoT
5	65.2	23.4	36.5	49.9	38.2	53.1
10	68.4	25.2	18.2	35.5	46.5	56.4
15	78.5	18.7	28.6	59.1	49.6	64.5
20	74.2	23.8	19.8	35.3	45.1	56.3
25	78.7	36.9	27.9	46.2	57.9	68.5
30	95.2	31.6	21.6	29.2	49.5	77.6
35	84.4	35.5	37.5	47.8	65.4	68.3
40	87.4	27.7	32.7	40.5	57.3	75.3
45	97.2	42.2	56.2	49.4	62.7	85.6
50	89.4	52.2	47.2	57.2	64.2	70.5
55	96.2	46.3	41.3	56.6	69.3	85.3
60	88.5	39.3	44.4	57.6	64.4	77.6
65	97.3	55.3	47.3	59.2	64.4	86.5
70	95.2	42.2	45.5	59.4	68.5	75.2
75	78.2	25.8	43.5	26.75	57.6	60.6
80	89.6	25.9	34.6	43.9	65.3	72.5
85	86.3	22.3	42.3	26.4	58.7	77.1
90	90.2	39.5	47.3	69.6	88.2	79.7
95	89.4	22.7	59.3	68.3	79.8	70.2
100	91.3	54.2	45.2	68.7	52.9	81.3

$\sqrt[3]{\prod p^R R p}$ through the wide range of applications in very high capacity.

5G wireless communication in teaching quality evaluation of college classroom education

Figure 5 illustrates the term teaching courseware, which refers to instructional software designed to be used on a computer by instructors, trainers, or students. Information technology is the most prevalent topic of study in course materials. The Interactive platform classroom is a dynamic learning environment that encourages students to participate in their education actively. The interactive platform combines both the students and teachers for evaluating the teaching sense of the teachers. The teaching courseware has the data stored and analyzed for understanding the capacity of students. Students walk about the classroom using various tools and interacting with electronic equipment, following the activities they are working on. The way of communication among all the devices the students is based on the 5G based wireless communication technology. Remote teachers can also make use of the various tools and can interact with the electronic equipment.

Teaching since has a great deal of power over the learning in their classrooms, and classroom teaching gives them that management—educators work to keep pupils

focused on education and avoid disrupting the process. An evaluation is an instructor’s assessment of a student’s progress in learning for grading and reporting, remote listing, and evaluation of various methodologies and measurements. Research Networking (RN) aims to find, discover, and use academic and research-related information about people and resources using various methods. Knowledge management systems serve as the backbone of the research network using research networking tools in the teaching and research network system. Within the field of education, educational administrators study the administrative theory and practice of educational institutions and educators in particular. When doing research, means using research methodologies to design and implement teaching practices that improve students’ and instructors’ learning outcomes. Participants in the research program approach their classroom responsibilities as if they were conducting research. To transmit data, wireless devices require radio frequencies (a spectrum). 5G, like 4G, makes use of higher, less crowded radio frequencies. As a result, it can transport more data at a much faster rate.

Assessment of teaching entails gathering information from various sources to improve the efficiency with which lessons are taught. First, a comprehensive review of previous developments and the present state of the educational system is carried out to identify the achievements and remaining issues. This is known as

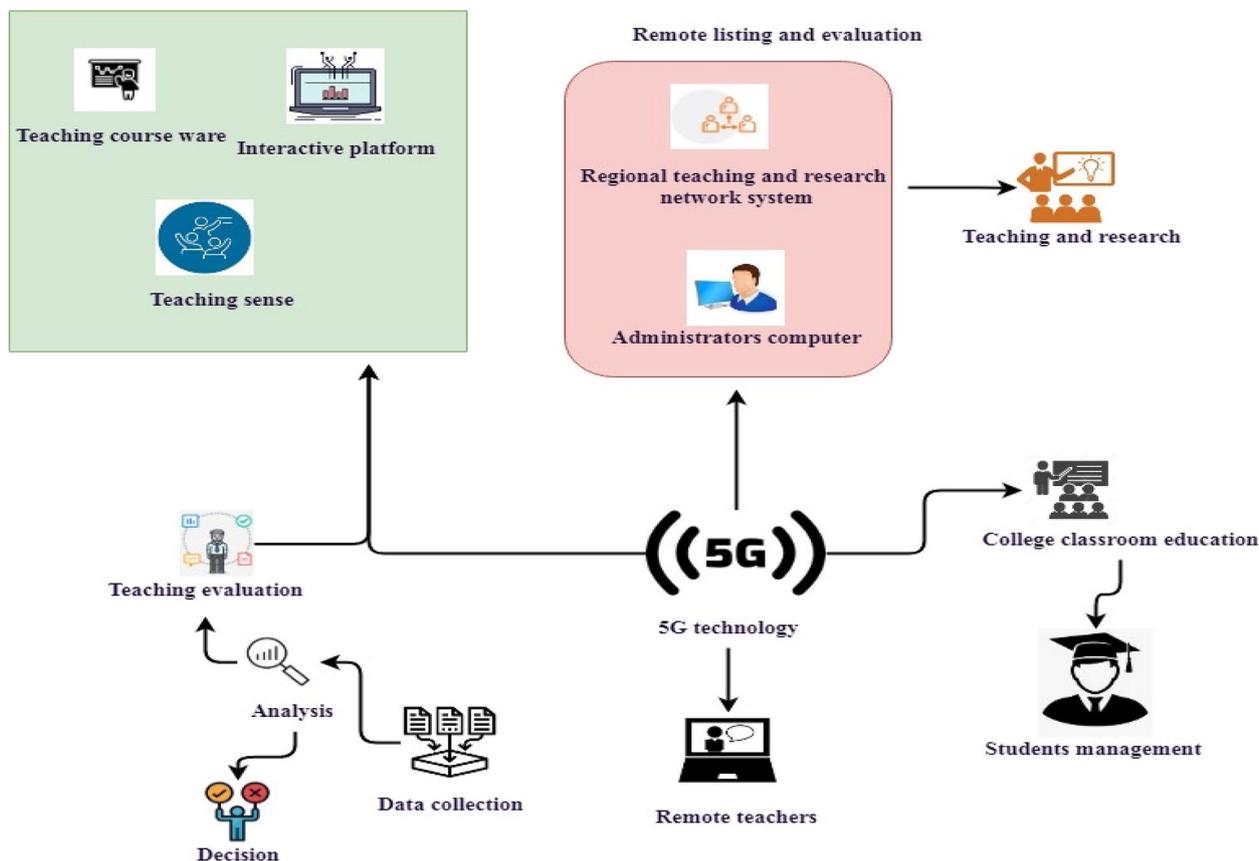


Fig. 5 5G wireless communication in teaching quality evaluation of college classroom education

an Education Sector Analysis (ESA). Choice education aims to help students obtain the information and skills they need to make sensible choices in their life. It’s possible to employ various data-gathering techniques to get the information need for this assessment of educational research and the numerous types of reviews used for data collection.

There is no physical classroom where remote instruction takes place. Teachers and pupils are separated by space and time. Teaching at a distance may be made possible via technology such as video conferencing software or discussion boards. Learning in a classroom is a typical style of education that takes place inside the confines of the classroom. In-College classroom education necessitates that both the instructor and student be present in the classroom at all times. Teachers and other college staff members must practice and perfect the art of student management over time. A teacher’s ability to properly manage their pupils is a skill set. The implementation of the 5G based wireless communication. Nowadays the physical classroom can be managed by teachers even from a distance place. The students from a distant place are separated by space and time. The way of

communication between them can be managed by video conferencing software or discussion boards. Video conferencing software is like an online or digital education platform.

The derivatives for 5G wireless communication in teaching quality evaluation of college classroom education

It is critical to calculating 5G wireless communication teaching courseware in the teaching quality evaluation of college classroom education using edge computing technology. Equation 5 calculates the teaching courseware for this purpose.

$$A = \frac{maxql}{2} \sqrt[3]{q} 1 / \sum q \left(\left(\frac{q}{l} \right) \right) \sqrt{l[\alpha]} \int q \tag{5}$$

The equation denotes that, *A* is the teaching courseware, *q* is no of test in technology access, *l* is planning for evaluation, β is the mathematical function of the discipline, *max* is a maximum of content, can be calculated for a comparative Analyzes of college classroom education in teaching quality in Fig. 8 $1 / \sum q \left(\left(\frac{q}{l} \right) \right) \sqrt{l[\alpha]} \int q$ passes through the interactive platform in a teaching sense. The

management of technology type for the teaching quality of college classroom education using edge computing and 5G wireless communication can be calculated using Eq. 6.

$$B = \sin(Q - 1)\varphi \sum Q \frac{Q}{f} \prod Q \int \int \int f - Q_f \quad (6)$$

The above equation indicates B is the management of technology type, Q is a password for technology, f is record mainatnce of self-efficiency in instructor, \sin is the trigonometric function of role as teacher, φ is the mathematical function of time availability, $\sin(Q - 1)\varphi \sum Q \frac{Q}{f} \prod Q$ in the remote listing and can be calculated for action ratio of 5G in college classroom education in the Table 2 evaluation from administrators computer from $\int \int \int f - Q_f$ regional teaching and research network system.

Teaching quality evaluation of college classroom education

Figure 6 shows how students, teachers, and administrators benefit from being recognized differently for their efforts. It conveys that excellent teaching and, by extension, student learning is valued. The evaluation of college classroom education consists of two major components: the evaluation of teaching quality based on training and intellectual quality.

According to the above figure, college classroom education depends on communication, instructional design, and teacher-student interaction. Individuals who want to become teachers are allowed to take a training course. These courses are frequently designed to be completed in a short period to achieve the desired outcome. Teachers must engage students in in-depth knowledge and comprehension of the

Table 2 Activity ratio of 5G in college classroom education

No. of students	AHP	IT	DBT-SVM	DM	IoT	5G-WCT
5	40.2	49.3	60.3	48.8	40.2	68.4
10	38.1	45.2	60.7	55.9	47.3	72.5
15	19.5	17.8	28.3	40.1	60.3	78.4
20	26.3	20.9	35.2	58.9	69.5	75.7
25	26.2	20.3	28.4	60.7	47.1	89.3
30	29.2	33.5	46.8	64.4	70.3	79.4
35	17	26.7	39.5	58.3	79.3	87.4
40	30.3	48.3	58.6	62.3	75.3	78.2
45	41.3	36.3	59.6	63.2	50.7	70.2
50	32.3	53.3	65.3	47.8	44.2	89.4
55	40.2	45.2	58.7	60.9	42.3	93.5
60	15	31.9	25.3	36.1	59.3	80.4
65	47.6	53.3	75.3	53.8	34.2	89.4
70	39.5	42.2	62.7	52.9	47.3	93.5
75	40.5	52.2	55.4	62.7	85.6	91.2
80	41.3	49.2	53.2	69.2	72.5	90.4
85	38.2	42.3	58.6	62.3	81.3	88.2
90	38.2	46.3	59.6	63.2	50.7	88.2
95	46.2	53.3	49.3	67.8	44.2	89.4
100	41.9	52.2	55.4	62.7	85.6	90.2

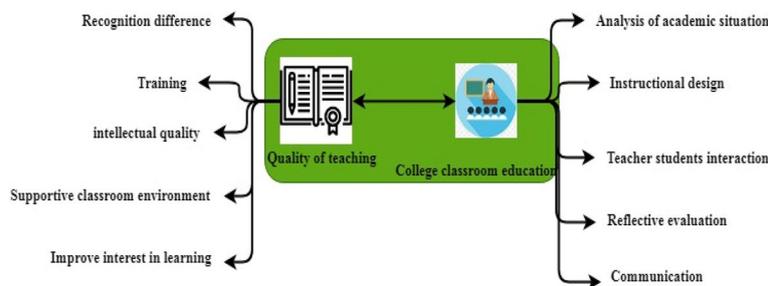


Fig. 6 Teaching quality evaluation of college classroom education

subject matter. Furthermore, to achieve intellectual quality, the teacher should develop tasks that allow students to apply their problematic abilities and engage students in higher-order thinking skills. Fostering satisfying relationships in the classroom leads to a more Supportive classroom environment, which is made possible by creating a safe and supportive learning environment. A teacher must find a method to make pupils feel at ease while studying. Students motivated by their interests are more likely to succeed in school and their careers. Improve interest in learning is a long-term tendency to return to a subject or thing that has captured one's attention and feelings in the past. Teachers' knowledge, talents, and abilities may be seen in the relevant educational experiences they produce for pupils. Teachers have a great deal of power over the learning in their classrooms, and college classroom education gives them that power.

Analyzing academic situations is minimized in the classroom so pupils can concentrate on their work. Internal and external research determines a company's strengths, weaknesses, opportunities, and threats and then uses that knowledge to help the company set its long-term goals and objectives. Educators strive to make learning as easy and convenient for students as feasible via instructional design. The learning aim lies at the heart of the instructional design process. The learner's end goal is to achieve this learning aim. Student-teacher interaction comfort and safety are enhanced when they have a good connection with their instructor. This results in increased academic engagement and engagement in the classroom. The design process improves the educational experience, and student performance enables the primary goal to be accomplished. The student-teacher relationship can be linked in the form of a high connection rate. Performance and engagement rates have the potential to enhance evaluation.

Reflective assessment is a kind of evaluation that makes use of reflective learning. Student progress may be tracked via reflective learning tasks that have been customized for this purpose. Two related fields of study, instructional communication and communication education, are called communication education. When it comes to teaching and learning, communication plays a significant role. Instructional communication focuses on how teachers communicate and how students react. The dashboard transmission of recognition difference in teaching quality of college students using edge computing and IoT technology can be calculated using Eq. 7.

$$D = ((K) + \iint w \frac{w}{(K-1)^2} \tan^{-1} \|K\| \binom{K}{w} \quad (7)$$

In the above equation, D represents the dashboard transmission of recognition difference, K is unified

assessment in training, \tan^{-1} is the trigonometric function of intellectual quality, w is feedback about a supportive classroom environment, $(K) + \iint w \frac{w}{(K-1)^2} \tan^{-1} \|K\|$ improving the effectiveness of the teaching-learning process $\binom{K}{w}$ action for development. The improved interest of students in college teaching can be calculated using Eq. 8.

$$E = H(m) \frac{m}{H} \mp \sqrt[3]{H} + \sqrt{m + \beta} \cos H \frac{1}{(m)} \quad (8)$$

In the above equation, E denotes improved interest in learning, H indicates evolving writing methodologies, m is automated recording in process, \cot is the trigonometric function of the analysis of the academic situation, β is the mathematical function of the 5G. $H(m) \frac{m}{H} \mp \sqrt[3]{H} + \sqrt{m + \beta} \cos H$ approach their classroom from $\frac{1}{(m)}$ teachers' performance and effectiveness in the instructional design. Finally, the management of end users in college teaching quality emulation using edge computing and IoT technology can be obtained using Eq. 9.

$$G = b/U (b) + \sec U \frac{1\delta}{\|b\|U} \sqrt[3]{b} \sum U \log b \quad (9)$$

The above equation indicates G to find the end-users of management, δ is the circuit platform of teacher-students interaction, U to current for responsibility in teaching, \log denotes the logarithmic function of reflective evaluation, b is the time taken to deliver communication, \sec is the trigonometric function of communication in using precise language, $b/U (b) + \sec U \frac{1\delta}{\|b\|U}$ providing students with feedback about their learning $\sqrt[3]{b} \sum U \log b$ summative evaluation.

These AHP, IT, DBT-SVM, and DM- IoT can be derived using Eq. 9 and the final result of 5G-WCT in Eq. 11.

Due to the unorganized classroom, effective teaching cannot be obtained which affects the performance level of students. Effective teaching and learning are obtained in the classrooms through different forms of communication. Good instructors validate the feedback obtained from the students based on effective teaching and learning in the form of performance. The ultra-low latency and high bandwidth of a 5G connection enable instructors to use mixed reality apps in all areas of education, giving students and trainees a better chance of understanding what they're learning. It employs a cell tower system to make long-distance phone calls and a center to connect apps for computational resources within the network infrastructure.

This study employs artificial intelligence as an information visualization procedure and edge computing for teaching quality evaluation of classroom education

under the guidance of behavioral framework theory. The proposed system will collect classroom education teaching materials in the testing used to test by analyzing the group members' participation in various interactions. The analysis method of this framework can expose a relationship between the attributes and perform the sensory system of the collected data to analyze and evaluate a learner's learning and thinking procedures. The AI framework for students is explored by coupling with their ability and conceptual structure for analysis, personalized and visual evaluation, and responses. The teaching evaluation method is developed using edge computing and AI. To produce any evidence, data processing, and so on, AI integrates specific components such as learners' behavioral framework, psychosocial outcomes, learning, and behavioral network. These elements appear to be a mutually agreed-upon collaboration between procedures consisting of connected edge devices based on the approach with basic strategies for teaching and learning. The goal is to promote the evolution of teaching quality in the classroom education AI framework and to enhance learning experiences through teaching quality evaluation. Figure 7 depicts the flow diagram of the AI method's evaluation method and edge computing.

Experimental analysis of 5G in college classroom education using edge computing and AI technology

When teachers don't have to deal with connectivity issues or interruptions in audio and video connections, they'll be able to concentrate on their students. In the future, students will be able to access films and other educational resources more quickly and even have holograms of guest lecturers appear in their classrooms. The implementation of edge computing and 5G technology in classroom education helps students to access all forms of advanced technology in education. The advanced technologies include the way to access films and guest lectures via video conference mode.

The capacity of teachers to raise students' performance on standardized achievement tests in fundamental academic disciplines like math and reading is often used to evaluate their effectiveness. 5G and edge computing education may allow students to learn how to utilize cutting-edge technology and design and create content using them because of its near-real-time reaction. For example, quizzes, essays, or final projects might be used to collect information in more conventional ways. Assessments are

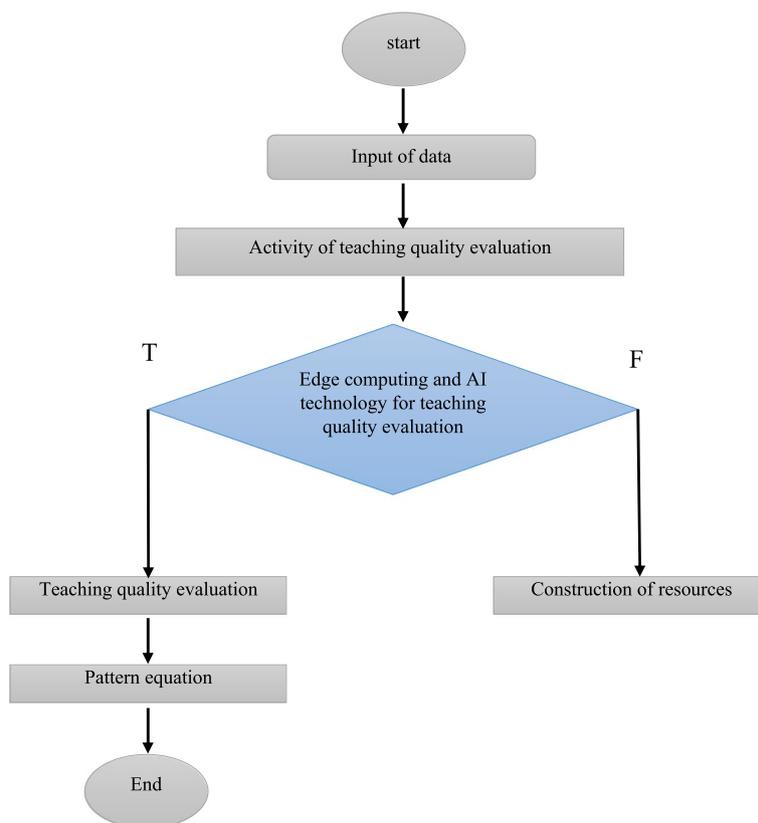


Fig. 7 Flow diagram of the AI method's evaluation method and edge computing

a great way to track individual development and see how the class is doing.

Dataset description

These are composed of 100 students chosen from a variety of special effects. Analyze which later stage course corresponds to the objective here. To put it another way, it is possible to group students based on their classroom education. Finally, the dataset values are derived from <https://www.kaggle.com/datasets/aljarah/xAPI-Edu-Data>.

Figure 8 illustrates performance scales; teachers may evaluate students’ progress toward a specific goal. Students will compare their learning aim to a performance scale to assess their progress. Achievement test results are often used as indicators of a teacher’s performance.

According to the above figure, a school with a high student–teacher or student-faculty ratio has more pupils than instructors. The relation between the teacher’s performance and the achievement of the student in academics is focused on the actual performance. The student ratio will be more than the faculty ratio. The achievement test result is centered on the teacher’s performance based on the curriculum. A Performance Scale is a scale from which the degree of accomplishment for a performance measure may be determined for any given level of actual performance.

$$I = J \tan_c \pi \iiint J \left(\frac{1}{\tan(J, c)} \right) \max_7 c \sqrt{c} \quad (10)$$

Equation 10 indicates I is the results, J to the remote teacher, c is the orientation, \tan is the trigonometric function of the settings, \max is the maximum in the climax, π is the students, $J \tan_c \pi \iiint J$ collecting validity evidence to evaluate the appropriateness $\left(\frac{1}{\tan(J, c)} \right) \max_7 c \sqrt{c}$ success outside of the workplace.

The above table illustrates that it is possible to assist students in remembering their knowledge using error analysis as an educational method. The error analysis is a form of evaluation of quality education and helps to assist students in all means of education. This should be noted that the error analysis is based on the performance of the second and foreign language acquisition. The knowledge, skills, and abilities of the students are focused on learning and teaching quality. Often referred to as erroneous examples, a problem statement and the processes used to arrive at a solution are provided as an example of error analysis. Second and foreign language acquisition necessitates studying error analysis in applied linguistics. Methodologically, it examines students’ mistakes.

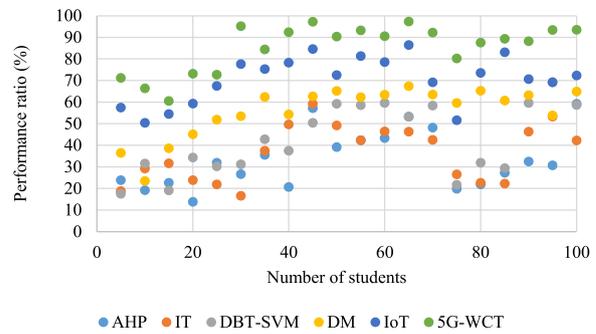


Fig. 8 Performance ratio of teaching quality

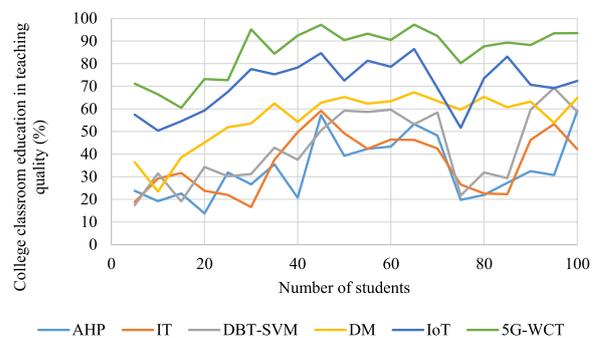


Fig. 9 Comparative Analyses of college classroom education in quality teaching

Based on Eq. (4), calculate the error rate ratio. Learning a language necessitates making mistakes along the way, which is an integral part of the process. Some of these studies might provide light on the complexities of language development and give a systematic approach to correcting students’ mistakes. Figure 9 analyzes the comparison of college classroom education in quality teaching.

The above Figure highlights the comparisons between groups throughout the time included in this term. Journal articles with a comparative feature will be used to demonstrate how comparative education is applied. The models and classifications presented in this paper will be reflected in the selection of articles. To be a successful Comparative Educator, one must be able to evaluate educational ideas and practices of different countries without bias based on factors such as population, race, size, and skin tone. Based on Eq. (5), calculate the Comparative Analyses of college classroom education in teaching quality. There should be no bias in favor of the system’s beliefs. To assist instructors in better understanding classroom issues such as diversity, conflict/peace, instructional methods, and curriculum and classroom organization from a broader global perspective, a study of the comparative education literature may be helpful.

The quality of teaching focuses on comparative analysis. The proposed wireless communication technology with edge computing solves problems related to curriculum, diversity, and classroom structure.

Table 2 illustrates when teachers don't have to deal with connectivity issues or interruptions in audio and video connections, they'll be able to concentrate on their students. Based on Eq. (6), calculate the activity ratio of 5G in college classroom education. In the future, students will be able to access films and other educational resources more quickly and even have holograms of guest lecturers appear in their classrooms. Immersive learning environments that allow scattered learners to interact are best simulated via 5G.

$$L = \iint N_{sec} \prod N \left(\frac{N}{\log(x)} \right) \|x\| \quad (11)$$

Equation 11 denotes L is the total monitoring, N is some layers, x to the management in character, sec is the trigonometric function of plot, \log to the logarithmic function of point of view, $\left(\frac{N}{\log(x)} \right) \|x\|$ teach anything relevant to the current scenario in wireless communication in $\iint N_{sec} \prod N$ In 5G.

Figure 10 depicts efficient learning as the achievement of educational outcomes such as test scores or value-added with the least amount of resources, whether the financial or innate ability of students.

The above figure predicts the efficiency of the student-teacher ratio based on the teaching quality results. Educational outcomes are measured by test scores or value-added courses. Only a small amount of resources is required for test scores or value-added courses. The test scores are used to assess students' attention.

Inefficiency measurement and Data Envelopment Analysis (DEA) are the two most often used methodologies (DEA). The student-teacher ratio may predict the class size and the number of customized attention

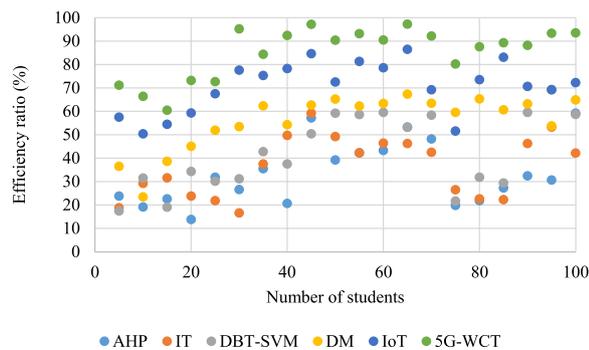


Fig. 10 Efficiency ratio of teaching quality

students. Research has demonstrated that lower class sizes are associated with improved student success. Cost-effectiveness analysis is often used to measure internal efficiency in education since it compares learning (a non-monetary output) to the expenses of educational inputs. Internal efficiency is concerned with the most efficient use of educational resources. Following the above experiments, it is possible to conclude that the scheme can function normally. The scheme can properly achieve the design's main functions and can handle and analyze teaching quality conditions within the estimated range. The test findings demonstrate that the scheme functions can be obtained usually, which decreases transmission delay and enhances the effectiveness of digital education in colleges.

Figure 11 depicts an analysis of the optimization algorithm in the context of AI and edge computing-based classroom teaching methods about the structure of self-education and integrating the concept of efficient teaching design. Edge computing classroom offers a fantastic practical suggestion with AI and does not have problem classifications within the time needed for research practice, verify or not verify.

Figure 12 shows that the searchability of the classifier's process improvement of an edge computing classroom teaching quality evaluation using the AI algorithm for a suggested classroom teaching procedure is greater than that of the optimization algorithm. In the suggested classroom teaching, the whole averages and variability of students' online humanity at large were 3.88 and 1.07, respectively. With such a high execution of technology naturalization education, the recommended classroom students' overall level of data naturalization education is significantly higher than the ordinary level.

Edge computing-based classroom teaching is an educational learning approach that has substantially expanded student-teacher communication. This learning process includes learning through online activities based on

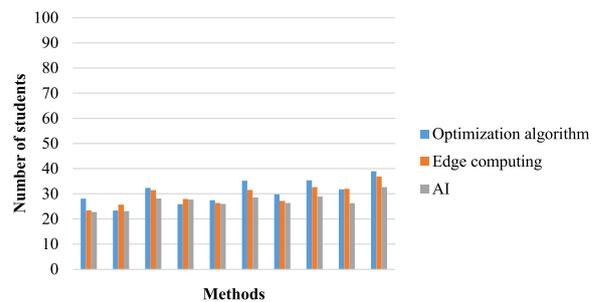


Fig. 11 The analysis of the optimization algorithm in the context of AI and edge computing-based classroom teaching methods

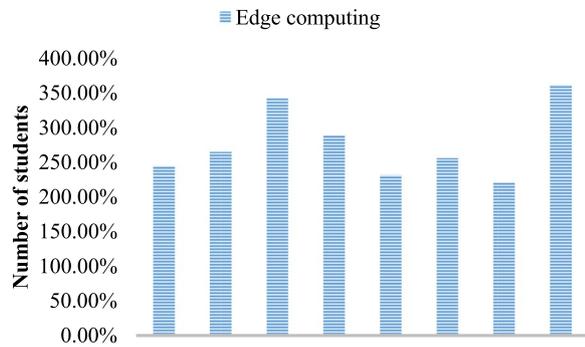


Fig. 12 The searchability of the classifier's process improvement of an edge computing classroom teaching quality evaluation

systematic to real-world AI applications and a variety of other exercises. These advantages demonstrate that the recommended classrooms reform or restructure the education system. A massive difference in the role of a teacher, the overview of different instructional modes, individual learning, active involvement of students in the teacher's exercises, and an increase in the variety of activities are all used to restructure classroom teaching. According to Fig. 13, the resource growth study of AI with "Not Confirm" rates the maximum value. An estimate of 20.12% and 87.76% of participants want to "verify" or "not verify," respectively. In the proposed system, only 27.2% and 33.34% of classroom teaching participants sought to "verify" or "not verify," with average values of 94.9% and 71.3%, respectively, particularly when compared to "resource report on time," where the overall mean is very large.

Artificial intelligence technology is used to digitize and visualize course materials, and edge computing technology, which can be used with or without an internet connection, is used to establish the systems that ensure the prepared materials are always available and easily accessible. Merging these two methods with teaching methods has shown significant improvements for classroom teaching efficiency and obtaining the desired outputs.

Figure 14 depicts the performance comparison of the proposed system for evaluating classroom teaching

quality using edge computing and AI. According to this figure, the current method is to demonstrate the teaching quality of classroom teaching training (92.45%) and test for overall accuracy (95.71%). Our proposed method for providing classroom education training (98.13%) and testing for overall accuracy of 97.24% yields a more accurate result than the present system.

Conclusions and future research directions

Teaching evaluation is gathering information from multiple stakeholders to improve the efficacy of the teaching–learning process. The complete process of teaching focuses on the assessment evaluation, and feedback obtained from students based on wireless communication teaching. The teaching quality can widely be enhanced by the 5G wireless communication technology. For an assessment to succeed, it must provide accurate, dependable, and actionable results. The construction of edge computing and mobile information systems is excellent for college English digital teaching. This article combines edge computing and 5G wireless communication technologies to develop a precise information scheme, mixes the school's numerous data resources, analyses the particular work process, and investigates the digital college. In this paper, we created a digital teaching framework for college students that can realize digital teaching, gather and incorporate teaching data, assist modern education, and realize sharing of resource. Using the recommended evaluation system will help students improve their critical thinking skills as well as their ability to collaborate in groups. The advancement of cutting-edge technology in the educational platform has the potential to improve 5G communication. All types of technological devices, smart devices, and gadgets from the IoT platform are used to implement cutting-edge technology. The mobile information scheme has enhanced the effectiveness of digital teaching organization in colleges and has expedited the implementation of digital English teaching in colleges.

The future research will combine deep learning and decision making technologies in teaching and learning with the internet English learning scheme and modify it to enhance

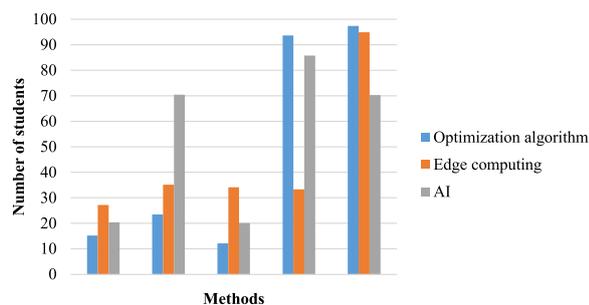


Fig. 13 Comparison of result examination of resource creation using the optimization algorithm

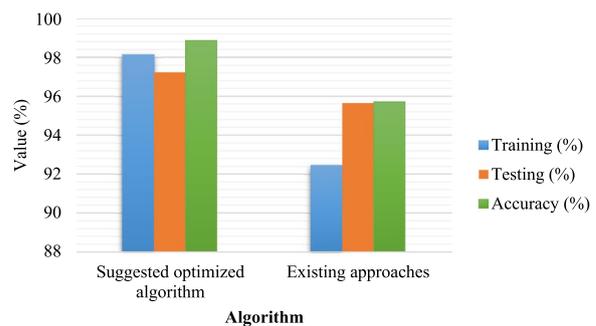


Fig. 14 Performance comparison in terms of training and testing accuracy

practicability and assist lecturers in monitoring students' attendance records, maintaining classroom discipline, and improving the online English classroom method. We will suggest neural network based teaching platforms that will have the capability to run on the edge and cloud platform simultaneously. The model training will happen at the cloud because of more powerful resources while the prediction will happen on the edge nearer to where the data is gathered. This will improve the response time further and, therefore, the overall efficiency of the digital teaching framework.

Authors' contributions

Feng Li: was mainly responsible for collecting data and composing articles. Caohui Wang: Mainly responsible for revising and checking articles. The author(s) read and approved the final manuscript.

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Availability of data and materials

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This declaration is not applicable.

Competing interests

These are no potential competing interests in our paper. And all authors have seen the manuscript and approved to submit to your journal. We confirm that the content of the manuscript has not been published or submitted for publication elsewhere.

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